15. (a) Expand $\cos 6\theta$ in terms of $\sin\theta$.

Or

(b) Prove that

$-64\sin^7\theta = \sin 7\theta - 7\sin 5\theta + 21\sin 3\theta - 35\sin\theta$.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Show that $\frac{1}{1\cdot 2\cdot 3} + \frac{1}{3\cdot 4\cdot 5} + \frac{1}{5\cdot 6\cdot 7} + \ldots\infty = \log 2 - \frac{1}{2}$.

17. Transform the equation $x^4 - 4x^3 - 18x^2 - 3x + 2 = 0$ into an equation with the third term absent.

18. Find the characteristic equation of the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and verify that it is satisfied by A. Also find A^{-1}.

19. Use Grammer's rule to solve $3x_1 + 4x_2 - 3x_3 = 5$, $3x_1 - 2x_2 + 4x_3 = 7$, $3x_1 + 2x_2 - x_3 = 3$.

20. Expand $\sin^3\theta\cos^4\theta$ in terms of sines of multiples of θ.

APRIL/MAY 2025

23UEEL12 — BASIC MATHEMATICS — I (ELECTIVE)

Shanmuga Industries Arts & Science College T.V.Malai

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Find the coefficient of x^n in the expression of e^{a+bx}.

2. Resolve into partial fractions $\frac{x}{(x-1)(2x+1)}$.

3. If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$ then find $\sum\alpha^2$.

4. Define Reciprocal equation.

5. Prove that the matrix $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ is orthogonal.

6. State Cayley Hamilton theorem.

7. If $A=\begin{bmatrix}1 & -1 & 2\\ 3 & 0 & 1\\ 1 & -1 & 0\end{bmatrix}$, find $A+A'$ and $A-A'$.

8. If $A=\begin{bmatrix}1 & 2 & 3\\ 1 & 3 & 4\\ 1 & 4 & 3\end{bmatrix}$, find $AdjA$.

9. Expand $\tan n\theta$.

10. Prove that $16\sin^5\theta=\sin 5\theta-5\sin 3\theta+10\sin\theta$.

SECTION B — ($5\times 5=25$ marks)

Answer ALL questions.

11. (a) Resolve into Partial fractions $\dfrac{x^2}{(x^2+1)(x^2+2)(x^2+3)}$.

Or

(b) Sum to infinite the series $1+\dfrac{1+2}{\lfloor 2}+\dfrac{1+2+2^2}{\lfloor 3}+\ldots\infty$.

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12. (a) Solve the equation $4x^4-20x^3+33x^2-20x+4=0$.

Or

(b) Diminish by 2 the roots of the equation $x^4+x^3-3x^2+2x-4=0$.

13. (a) Find all the characteristic vectors of the matrix $\begin{bmatrix}3 & 2\\ 2 & 3\end{bmatrix}=0$.

Or

(b) Show that the matrix $\begin{bmatrix}0 & c & -b\\ -c & 0 & a\\ b & -a & 0\end{bmatrix}$ satisfies Cayley Hamilton's Theorem.

14. (a) Find the value of x and y if $2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$.

Or

(b) If $A=\begin{bmatrix}2 & 4 & 4\\ 2 & 5 & 4\\ 2 & 5 & 3\end{bmatrix}$ then find A^{-1}.